Oklahoma Agricultural Experiment Station,

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FIELD EXPERIMENTS.

SUGAR BEETS AND MANGELS.

These crops have been grown on the station farm, more or less irregularly, since the opening of the work here in 1892. In 1897, experiments were taken up in co-operation with the U. S. Department of Agriculture to study the adaptability of Oklahoma soils and conditions for growing sugar beets for sugar production. The results of this work have been reported elsewhere in the station publications. While the results gave very little encouragement to those wishing to boom the beet sugar industry in Oklahoma, they indicated that growing beets as a stock food might prove very profitable.

In Oklahoma, with its very open winters that generally afford a growth of wheat through the winter months that makes a pasture not excelled by a pasture of Kentucky blue grass in June, the need of succulent feed such as silage and root crops is not felt as it is in the northern states when everything is frozen up for three or four months of the year. But there are times during almost every season in Oklahoma when the wheat pasture is not available and a few pounds of mangels to furnish succulency to the ration of dry feed would greatly stimulate the appetite and digestion and aid in keeping animals in a vigorous, healthy condi-

tion. These root crops are particularly valuable as an addition to the ration of breeding and growing stock and dairy cattle. The pregnant cow, mare, sow, or ewe needs some food of this nature and very frequently wheat pasture is not available or convenient to use. At time of breeding, if a portion of the ration is a succulent feed, little trouble will be experienced in getting animals to "catch." In Oklahoma, sugar beets or mangels are available from the first of September to at least the last of May, where they are stored properly. They should be fed as only a portion of the ration, eight to fifteen pounds per day for a cow, although much more might be fed if they were plentiful and cheap and the only source of succulent feed.

For stock feeding, mangels, or stock beets, as they are called, fill the place of sugar beets very well. The mangels contain less food material per hundred pounds than the sugar beets but the mangels generally yield considerably more per acre, and are generally considered more easily raised than the sugar beets.

In the spring of 1900 a plan was formulated to obtain the comparative yields of sugar beets and mangels on the station farm and to ascertain the practicability of growing these crops for stock food in Oklahoma. For a series of years, good sized patches of some of the standard varieties of mangels and sugar beets are to be grown.

RESULTS IN 1900.

The crop was situated in a field where the soil is of a stiff heavy nature underlaid with a gumbo subsoil. The field received an application of barnyard manure several years previous to this cropping.

The soil was prepared by plowing in March and floating and thorough harrowing. The seeding was done on April 16th with a one-horse drill. The seed was put on very liberally in rows thirty inches apart, the seed being covered about one inch deep. Two varieties of sugar beets, White Improved and Kleinwanzlebener, and two varieties of mangels, Eiffel Tower and Golden Tankard, were planted with seed purchased that season, but the seed was not soaked before planting and the stand obtained was so very poor that the plats were disked up and seeded to other crops. At the time of the other seeding a fifth plat was seeded to sugar beets of an unknown variety, the seed having been on hand for a year or two and the label lost. As the seed was old, it was soaked for over twenty-four hours, and a perfect stand was the result. The top soil was a little dry at the time of seeding.

The sugar beets on this plat were up May 3rd and were cultivated with a hand plow May 4th. May 9th, the plat was cultivated crosswise with a Hallock weeder. After this treatment the plants were thinned to a stand six to ten inches apart. May 14th, cultivated with hand plow. June 2, cultivated with horse cultivator. July 19th, cultivated. July 31, plowed with cotton sweep to throw dirt to beets. The harvesting was done the last week in November and the beets were pulled and stored in a long rick, then covered with straw and dirt, the details of which will be given later. The beets were loosened by running a furrow close to each side of the row with a cultivator shovel drawn by a horse. After treating in this manner, they were easily pulled by hand and the tops twisted off before they were thrown down. This plat contained a little over an acre and produced at the rate of 9.81 tons of beets per acre.

RESULTS IN 1901.

The plats were situated in the same field as in 1900, but were in a different portion of the field. The crop was drilled on April 13th in rows thirty inches apart. The plants were well above ground by the last of the month and a very fair stand was obtained. Mammoth Long Red, and Golden Tankard mangels and White Improved sugar beets were planted. The plants were thinned where there were two or more in a place. The crop was kept clean by frequent cultivation during the season and the growth was very fair. The total crop harvested the latter part of November turned out 8,314 pounds. The yields of the individual plats per acre cannot be given as the measurements of the plats were lost, but the crop was considered a good average.

RESULTS IN 1902.

During the season of 1902 this experiment was caried out on soil similar in character to that described under the 1900 experiment. It would be designated as loam surface with a heavy, impervious subsoil. The portion of the field on which these roots were grown had been manured several years previous with barnyard manure. The field was plowed in January to a depth of eight or nine inches, and then harrowed. The soil was harrowed twice prior to seeding.

The seed was sown on the 9th of April with a shoe drill in rows thirty inches apart. The soil was in good condition at time of planting and contained sufficient moisture to germinate seed rapidly. On April 24th most of the plants were up and the plats were cultivated two days

later. The soil was again stirred on May 10th with a five-toothed hand cultivator. After beets had been growing for one month they were thinned out to a stand of one plant to every six inches and surplus plants were used to fill up deficiencies in rows. The major portion of plants that were reset lived and this aided to quite an extent in filling out vacant places and insuring a uniform stand. The plats were cultivated with spring-tooth cultivator on May 27th and again on June 30th. During the growing season it was necessary to go over ground twice with hoes in order to cut out the few weeds which the cultivator had missed.

The month of August being comparatively dry, the roots did not make a normal growth and at the beginning of September they were very small. From September 20th to October 1st several heavy showers fell and the soil became thoroughly moistened. Fine weather followed during the month of October and the beets grew rapidly until time of harvesting.

The rainfall during November was excessively high and owing to the fact that the soil was very wet, harvesting did not commence until December 1st. The weather turned cold December 3 and the soil was frozen to such an extent that it was impossible to finish taking out roots. The Mammoth Long Red mangels suffered the most from this freeze, due to the fact that they grow in large part above the surface. The White Kleinwanzlebener variety was not damaged very much, as these beets grow quite deeply in the soil and they have a very heavy top, which afforded some protection.

Three varieties were grown this season and the yields are as follows: Mammoth Long Red, 17.5 tons per acre; White Kleinwanzlebener, 14.1 tons per acre; Golden Tankard, 13.3 tons per acre.

RESULTS IN 1903.

The plats this year were located on the same field as last year but on another portion of it. The soil is quite similar in character over the entire field but the portion upon which beets were grown this year has received no manure since soil was broken. This part of the field has one or two small alkali patches on it. The beets appeared to grow almost as large on these patches as on other portions of the field.

The field was plowed April 14th at a depth of seven inches and the ground was harrowed immediately. This treatment left the field in excellent condition. The planker was used to compact the surface somewhat and break any lumps that might be found.

The plats were seeded April 16 with a shoe drill in rows twenty-four

inches apart, the seed being placed in soil about one inch deep. The seed was soaked in water for about twelve hours prior to time of drilling. The water was then drained off and the seed was spread out on a floor under the direct rays of the sun and allowed to remain for two or three hours, until the surplus moisture was removed. If seed that is soaked in water is not treated in this manner, some difficulty will be encountered in getting it to pass through the feeder in the drill. Nine pounds of seed were used to seed an acre. Ten days after seeding the young plants were showing nicely, a fair stand having been obtained on all plats except one. In this latter case, the seed was distributed rather unevenly owing to fact that it was rather moist after being soaked and thus did not feed freely. The roots were thinned from May 28th to June 4th to a stand of one plant per six inches. The work should have been done at an earlier date, for the plants were quite large at that time, but heavy rains during the month kept the soil wet and unfavorable for thinning. The surplus plants were used to fill up vacant spaces in the plats, but unfortunately weather conditions were such that a very small percentage of the transplanted plants lived. A few warm sunny days that followed the cool weather of May cooked the plants which were transplanted.

The plats were cultivated on June 8th with a single horse cultivator. Three days later the weeder was used. This machine stirred the soil around the small plants and covered up a large number of small weeds which could not be reached by a larger cultivator. The three plats were given three cultivations, June 29th, July 7th, and July 15th, with a single horse cultivator. The patch was hoed out twice during the season.

The season as a whole was favorable to the growth of the crop. The soil dried out quite a little in August, but subsequent showers were of sufficient duration to moisten the soil thoroughly. The White Kleinwanzlebener variety was damaged to some extent with leaf spot. The Golden Tankard variety was also affected to a slight degree.

Three varieties were used in the experiments and the yields are as follows: Golden Tankard, 13 tons per acre; White Kleinwanzlebener, 7.27 tons per acre; Long Red Mangel, 7.2 tons per acre. The crop was harvested November 9th to 13th.

SUMMARY.

For the two years, the Golden Tankard mangel gave a slightly larger yield than the Long Red mangel. The sugar beet was not far behind the mangels in yields. It is a very difficult matter to get an accurate

yield test as the stands vary so much from year to year. The Golden Tankard mangel is probably the best known and most extensively grown, although the Long Red mangel under different names is largely grown. Beet seed usually costs from twenty-five to forty cents per pound. Great care should be exercised in buying seed as much worthless stuff is sold. These root crops grown on the station farm have been utilized as feed for all kinds of stock and although we have abundance of wheat pasture during the winter, we consider them a profitable and indispensable article in the rations.

GENERAL SUGGESTIONS.

It may be stated in a general way that any soil that will produce corn, wheat and oats will yield a paying crop of these roots. The best yields are obtained on deep, mellow soils of an open nature. Where the soils are of a heavy character and the subsoil a stiff clay, subsoiling will increase the yields and should be practiced when possible, but subsoiling is not necessary in order to produce paying yields on such soils, and rather than to pass the crop by if subsoiling cannot be done, it should be seeded without subsoiling. If the beets are grown for sugar production, subsoiling is considered necessary on heavy soils. Good deep plowing, eight to ten inches deep, is feasible and should be practiced for these crops and it should be done during the winter or early spring. If heavy rains have run the soil together before seeding the ground should be replowed. At all times a fine, mellow seed bed should be prepared by frequent harrowings before the seed is planted. A rolling or floating very often aids much in getting the seed bed in shape.

In order to lessen the cost of cultivation a clean piece of land should be selected to plant on. Beets on foul land are a very expensive crop. Early seeding is by far the most desirable, and in Oklahoma, this means early in April, although beets planted in May have made a fair crop this far south. The crop should be planted in rows and cultivated. Larger yields can be obtained by having the rows as close as 18 inches but the extra expense of cultivation overbalances the lighter yield from rows farther apart. This station recommends that the rows be put far enough apart so that a two horse cultivator can be readily used, and for this the rows should be 30 inches apart. If a regular beet drill is not available, a cotton or a corn drill may be used with a little fixing, but the best drill to use is a wheat drill. The seed should not be put in until they can go into moist soil and to obtain this condition they may be covered to a

depth of one and a half inches. Half an inch is deep enough if the soil is in good condition and the weather favorable.

Getting a stand is one of the most difficult factors in beet culture and one of the greatest drawbacks to the crop. Most of the seed used in this country is imported from Europe and before much of it reaches the hands of the farmer, it has lost its vitality and much of it contains trash. The seed as purchased is made up of pods, each one generally containing from two to three seeds, and it apears to the grower as if all of these in one pod grow or none grow and he has his plants in bunches with numerous skips between. Due to this characteristic of the seeds containing several germs in a pod and generally producing two or more plants in a place, thinning is unavoidable and is quite an expensive part of the operation. It should be done while the plants are small, after they have produced the fourth leaf, and can be accomplished only with the fingers.

The plants that are pulled out grow quite readily when transplanted and may be used to fill in the skips in the rows if help is available and is not too expensive to do the work. In this way many irregular stands may be converted into good even stands. Transplanting sugar beets where the crop is grown for sugar production is not recommended by many.

In drilling, the drill should be set so as to scatter the seed in the row thickly, a seed pod every inch is not too thick. This will require eight to ten pounds of seed per acre if the rows are about 30 inches apart.

Beet seed germinates very slowly and the process is greatly hastened and insured by soaking the seed for twenty-four hours in water just before seeding. To get them in condition for seeding after they have been soaked, take out and drain and then spread out in the wind and stir frequently until the outside is sufficiently dry, which under favorable conditions will be in a couple of hours. If anything happens to interfere with putting all the seed in at once after it has been soaked, cover it up so that it will not dry out and it will keep for several days if kept cool.

The coming up period and the first few weeks after this are the critical times with the beets. Where much rain has fallen after seeding and before the crop is up, on heavy soils, a crust forms that makes it difficult for the plants to penetrate and unless this crust is broken in some way many of the plants never come through. A hand rake or a horse weeder does this work very nicely. The plants are very small and grow slowly at first, so stirring the soil must commence before the usual

methods of cultivation. If the soil is stirred between the rows with a cultivator, the soil so loosened may be distributed around the small plants with a harrow or weeder. As the plants are some time in coming up, it is well to harrow lightly about a week after the seeding. After the plants are of sufficient size, the weeds should be kept out and the surface kept mellow with the regular cultivator.

A drouth will check the growth of beets but if the soil is in good tilth they will live and when fall rains come will make much more growth before harvest time. This fall growth is allowable when the beets are for stock feeding but is considered detrimental when they are to be used for sugar production. The harvesting should be postponed until cool weather. As a rule in Oklahoma they will not be damaged by freezing in the field before the first or middle of November. In many seasons, they might remain in the field until the first of January. The tops cover them so that a light freeze does not reach them.

In this country, it is not advisable to go to the expense of making a root cellar or cave. Beets or mangels keep in perfect condition if piled in ricks and covered with straw and earth. For the past four years the following plan has been followed at this station and the beets and mangels have been preserved in fine shape. As pulled, the tops are twisted off and the roots are thrown into small piles in the field to be gathered up later with the wagon. For storage space, a plot of ground is selected where the drainage is good. A light layer of straw is spread where the beets are to be piled. The piles are generally made five or six feet at the base and run up to a peak which is about four feet from the ground. The pile is then covered with about six inches of loose straw. This is then covered with three to five inches of dirt with the exception of a space of about 8 to 10 inches wide at the top of the pile which is generally left open most of the winter, being covered with nothing but the straw. The dirt for covering is obtained by digging a trench about two feet from the edge of the beet pile. When the roots are wanted for use, one end is opened and the roots removed as needed, care being taken to cover the opening with straw each time.

These root crops will not attract the farmer who is contented to put all his land in wheat or cotton and keeps a very indifferent kind of stock if any, but the farmer who is striving to maintain the fertility of his soil by diversified cropping, and is utilizing the larger portion of these crops as feed for improved stock, should see the advantage in growing a small acreage of root crops and act accordingly.

KAFIR CORN AND INDIAN CORN.

In many parts of Oklahoma, Kafir corn has been one of the staple crops since the opening of the country, but in other sections where it was grown quite extensively at first, particularly in the eastern portion of the Territory, the acreage has been much contracted and very little is grown in some parts now. It is doubtful if the total acreage in Oklahoma in 1903 was as much as it was five years ago. The cause of this falling off in acreage in Oklahoma cannot be definitely stated. In Kansas the acreage has steadily and rapidly increased as is shown by the last record in 1902. Since 1893 the increase in acreage in that state in the nine years has been over 400 per cent. Some have given the following reasons for the shrinking in Oklahoma. Probably it is due to the fact that the crop is not as easily and economically harvested and stored as Indian corn and for most purposes must have special preparation for feeding in order to obtain desirable results, which is not the case with Indian corn. Again, it is not as salable an article as Indian corn nor is it equal in feeding value. While it is true that Indian corn takes the lead in these respects, the difference is not great. On the other hand each succeeding year has proven Kafir corn far better able to produce grain and forage on the uplands in Oklahoma. On such land in the drouthy years, corn is a total failure while Kafir yields a fair crop of grain and stover. In the good seasons on the bottom lands, corn equals Kafir but in a drouthy season the Kafir will produce the most grain. Generally, particularly on the uplands, where the growing of Kafir has been abandoned, no grain crop is grown except wheat and a little oats, and the time will probably come again when Kafir will be much more extensively grown on these uplands.

RECENT EXPERIMENTS.

Some of the first work started at the Oklahoma experiment station was experiments to ascertain the comparative yields of corn and Kafir corn. Results up to 1900 have been published in previous bulletins. The following results for 1900 to 1903 will afford the purpose of such comparisons although the experiments were really planned for other purposes and the plats are not quite as near together as they should be for close comparison. The results are from half-acre plats that are in some rotation and cropping experiments, the details of which will not be given here as they will be published later. In these experiments, each treatment is carried out on manured and unmanured ground.

The details of planting, cultivating, and harvesting for each year will not be given here but the following general plans were followed out: For the Kafir corn the ground was plowed in the winter or early spring and thoroughly worked down with a harrow until a fine mellow seed bed was obtained, always giving one harrowing just previous to planting. Surface planting with a wheat drill or corn or cotton drill was practiced. As a rule, the rows were made three feet apart and the seed was dropped very thick in the row to be thinned to the desired stand after the plants had obtained some size. The seeding was done the latter half of April as a rule. The first and second cultivations were made with a harrow and one of these crosswise of the rows so as to thin out the plants. After the first cultivation with the cultivator, the plants were thinned to a stand of one plant every four to six inches. Generally three cultivations with the corn cultivator were made during the season. The grain was usually ripe early in September at which time the fodder was cut and shocked and allowed to remain in this condition for at least two months. Then the heads were cut off and the grain thrashed and the fodder stacked. The black-hulled white variety was used each year.

The corn was drilled in rows three and one-half feet apart and as far as possible there was a stalk every sixteen inches in the rows. The ground was prepared by winter plowing and shallow furrows were opened up with a lister at the time of planting. The best of cultivation was given during the season.

COMPARATIVE YIELDS.

The following table gives the yields of grain and stover per acre for the four years.

Year.	Treatment	Kafir Corn, Yield per Acre.		Corn. Yield per Acre.	
		Stover Tons.	Grain Bushels	Stover Tons.	Grain Bushe
1900	Manured	5.12	41.07	2.17	17.27
	Unmanured	3.51	31.68	1.63	18.92
1901	Manured	2.18	27.2	.....	.....
	Unmanured	2.15	26.9	.7	0.16
1902	Manured	3.1	32.3	.....	.....
	Unmanured	2.83	20.6	1.48	8.2
1903	Manured	3.57	35.2	1.25	37.22
	Unmanured	2.99	28.9	.87	17.48
Average	Manured	3.49	33.94	1.71	27.24
	Unmanured	2.87	27.02	1.17	11.19

In 1901 the total weight of the Kafir fodder was taken on each plat and then the heads cut off and thrashed and the grain weighed but the weights of the grain were lost so that the only way to get the yield of grain and stover separate for this year was to compute the proportions of grain and stover from the total weight of crop. For the years of 1900, 1902, and 1903, 26 per cent of the total crop was grain and the 1901 yields were computed on this basis.

The yields of the Kafir corn grain as given in the table are 1-4 to1-3 below the actual amount of grain produced as the English sparrows took about this amount of the grain while it was growing. Every effort was made to keep them out of the standing crop but with poor success. After the crop was cut the shocks were covered with sacking that stopped further loss from this source.

The corn crop of 1901 was practically a total failure due to a very dry season. The season of 1902 was somewhat more favorable but a dry spell struck the corn plats in this experiment just in the critical time

of silking and shooting. The corn crop of 1900 suffered considerable from drouthy conditions and the manured plots in this experiment had tillered considerably and made a rank growth which made these plats suffer more from the drouth than did the unmanured plats. Several times, severe dry spells were under way while the Kafir was heading and the grain forming.

In 1902 ten varieties of corn grown in another field yielded from three and one-half to twelve bushels per acre. In 1903 five varieties of corn grown in another field yielded from seventeen and one-half to twenty-three and one-half bushels per acre.

In 1902 the Kafir stover and corn stover was sampled for moisture determination and the former found to contain 75.8 per cent dry matter and the corn stover 80.22 per cent of dry mater.

SUPERIORITY OF KAFIR ON UPLANDS.

Table one shows very clearly the superiority of Kafir corn over corn for producing grain and stover on heavy upland soil in the average season in Oklahoma. On the manured ground Kafir produced 51 per cent more stover and 19.7 per cent more grain than the corn. On the unmanured ground the Kafir yielded 59.2 per cent more stover and 48.5 per cent more grain. These percentages are computed on the averages for the four years.

FEEDING VALUE.

There is little doubt left as to the comparative yield of these two crops, particularly on the uplands. It is now conceded that for cattle and hogs the feeding value of Kafir corn is about 15 per cent below that of corn. Feeding experiments at this station give about the above difference. This is when the grains are ground. The unground grain will not give nearly as good results in comparison as the ground grain. For horses and sheep, the difference in value is less and Kafir corn is considered by many to be equal to corn. For cattle, if the grain is not thrashed and ground the results will not be satisfactory and a great deal of waste will occur. Kafir stover is generally far superior to corn stover in this country. It is not in the shock as early in the fall to weather and bleach; it is harvested in a nice green condition with most of the leaves still on; it is more compact in the shock, hence suffers less damage from the weather; and a larger proportion of the stover is eaten than there is of the corn stover.

CHARACTERISTICS OF KAFIR CORN.

To encourage better methods in raising this crop and to answer the inquiries of farmers new to the territory who are not familiar with the raising of the crop, the following summary is given: Kafir corn responds well on rich, deep soil, but its great value lies in the fact that it will produce 25 to 40 bushels of grain on stiff, heavy soil that will not produce a paying crop of corn in the average season in Oklahoma. Hence the selection of the soil is a simple matter.

Another very strong feature of the crop is its dry weather resisting qualities. It has a very vigorous, deep and extensive root system that pumps the water from a great area of soil. Again if all the moisture within reach of the plant is exhausted, the plant rests in a dormant state, which very frequently lasts for several weeks, until rain comes and then the crop takes a new start and completes its growth.

Several years ago three varieties were grown, the red, the white, and the black-hulled white. The first two have been practically abandoned for the black-hulled white. It is the only variety grown on the station farm now, as it has proven the most desirable variety. Kafir corn has greatly deteriorated in productive power on the average farm since it was introduced. This is due to the fact that no atention is paid to seed selection, as seed is taken from the general crop, where the quality is often very inferior, without making any selection. The seed should be selected before the crop is cut by choosing good, compact, long heads that are well filled at the butt and that run up to a good square top. These should be taken care of in such a manner that they will not mold before they are cured. Kafir corn is a warm weather plant and is a weak germinator, particularly in cold, wet ground. The seed is small and the early growth is much slower than that of corn. For the above reasons, in order to get a good stand a liberal supply of seed should be put on and if the stand is a little thick it may be thinned out by cross harrowing while the plants are small. For the maximum production of grain and stover the stalks should stand four to six inches apart in the row. This is best obtained by putting the seed in thick as stated above and thinning out by cross harrowing. For dry sections the stand should not be quite as close as this. The lister is sometimes used in seeding the crop but it is not a desirable way as a rule only on light open soils in the western districts. When put in this way the seed generally goes into cold ground and is in much danger of being drowned out and covered up with heavy rains and the very small, slow-growing plant at first is very hard to cultivate in the

bottom of the lister row. The seed does not readily push through soil that has been washed over it. Surface planting is much more desirable as the crop can be more successfully started. The rows should be as close as the working of a two horse cultivator will permit, which is about 30 inches. The preparation of the seed bed does not differ from that for corn but particular pains should be exercised to see that it is fine and mellow as the seed is small and delicate. Again it is important to give all weeds a back-set by a good harrowing just before the seeding of the Kafir corn.

The characteristics of the seed and the early growth of the plant should be borne in mind and the seeding deferred until the soil is warm and the weather settled, and generally this will be by the middle of April in this country.

The seed can be most readily put in with a wheat drill by closing the feed spouts that are not wanted. The ordinary drill should be set to seed about 1 1-2 bushels of wheat but this should be tested for each drill. For cultivation the soil should be kept well stirred and free of weeds as possible. The work should start with one or two good harrowings, one of which should be made crosswise of the rows and the harrow so adjusted and operated that the plants will be thinned to the desired stand.

HARVESTING.

If the crop is grown principally for the grain and little is expected of the stover, the grain may be gathered any time after two or three weeks have elapsed after the ripening of the grain. If full value is to be gotten out of the stover as well, the crop should be cut as soon as the grain ripens. Due to the fact that the leaves and stalks remain green until the grain is ripe, and usually long after this time, the harvesting is often put off for some time after the grain is ripe. After the seed ripens, the stalk and leaves deteriorate in value by becoming woody and unpalatable.

The problem of harvesting the Kafir crop has bothered a great many and probably the fact that the operation is a little more difficult than with corn and requires a little cash outlay for thrashing, has been the cause of some abandoning the growing of the crop. Several methods are used in harvesting the crop: the heads are cut off in various ways while the crop is standing; the fodder is first cut and shocked and the heads cut off later; sometimes the heads are not cut off but the whole

plant is run through the thrasher, or the heads put in far enough to remove the grain and the rest of the fodder then removed. The next to the last method was never very popular and is seldom used now as it is a very expensive operation. The heads are broken or cut off by hand while the crop is standing or one of the various headers that have been made for the purpose is used. Some of these headers are complete in themselves, containing the box for holding the heads as cut mounted on wheels and arranged to be drawn by a team. Another kind that is being used very successfully on the station farm is one that is attached to the side of a wagon box and is run by a sprocket wheel on the hind wheel of the wagon. The make of this header is the Eagle, and it cuts the heads off and elevates them into the wagon as the team walks. It is an implement that should be owned by all who expect to grow Kafir corn to any extent. When the harvesting is by hand many prefer to break the heads off close to the butt and state that more bushels can be gathered in a day than can be gathered in corn husking. A jack knife can be readily used for severing the heads. If the heads are to be gathered before the fodder is cut, which has been stated should be done shortly after the grain is ripe, and if the fodder is to be saved, some precaution will have to be taken to keep the heads from moulding. This is done by putting them in small stacks with alternate layers of straw, or in small piles on the sod if the weather is favorable.

The fodder may be cut by hand, with the various sled cutters, with the grain binders, or better still, with the corn binders. If one is raising much Kafir corn, undoubtedly a corn binder will pay. Not only does it put the fodder in good shape for handling but when in bundles the heading can be done with much less trouble and expense. The heads are taken off the cut fodder by putting the tops of the bundles over a block fixed for the purpose and severing the heads with several blows of a broad ax or corn knife. Taking off the heads with a cutting or chaffing box is a very rapid and convenient way, as the bundle is placed in the box and the heads taken off with one shear of the knife without shattering any grain. The heads are very readily thrashed in the common thrasher, but this should not be done until the heads have cured several weeks after cutting, if the grain is to be stored in large quantities.

At the time of thrashing, the heads should be dry, as damp Kafir corn heats readily. As a rule if the stover is to be stacked in fair sized stacks it should remain in the shock at least two months, as it will heat if stacked before this time. If thrashed Kafir corn is to be kept in large quantities in tight bins through the spring and summer, great care

must be exercised or it will heat and mold. This may happen to grain stored in the best of condition, particularly if the weather is a little damp, and the weevils get into it. Weevils are a great pest in this grain that is stored in bins during the summer, and do much damage. If the storing is for any length of time it is better accomplished while the grain is on the heads. The grain saved for planting should be kept on the heads or if thrashed, in open sacks in a dry place. No legal weight for a bushel of Kafir corn has been adopted in Oklahoma, but it should be 56 pounds, and this is the legal weight in Kansas. The question is often asked how many pounds of the grain in the head should be allowed for a bushel of grain. It requires from 75 to 80 pounds. If the heads are large and well filled and cut close to the butt and are dry, 75 pounds of the heads will thrash out 56 pounds of grain. If the stems on them are long and are mixed with more or less leaves and are damp, it will take 80 pounds to yield 56 pounds of grain. A determination of the average of seven loads of Kafir heads, well tramped in and hauled several miles, gave two inches in depth in a wagon box three by ten feet as equal to one bushel of Kafir corn.

Where the seed is planted as we have recommended, it will require six to ten pounds per acre.

The statement is quite commonly made that Kafir corn is hard on the soil. This is true only to the extent that it is a very heavy producer and draws on the soil to that extent for plant food and moisture. It generally leaves the ground well sapped of moisture and if sufficient rain does not fall to wet the soil thoroughly before the next crop is planted it is likely to do poorly on account of the lack of moisture. The crop does not remove any particular element from the soil that is felt by following crops other than is removed by most other crops. The very extensive and vigorous root system of the Kafir corn affords a larger feeding surface than that of most of the common crops.

OATS.

The oats crop is not an extensive one on the station farm as a rule, but more or less of it is grown each season and usually the yields are good, many times they are excellent and seldom very poor. Few special experiments have been carried on with oats at this station, but it is included every year in several rotation experiments, and a few variety tests are under way.

RESULTS IN 1900.

During the season of 1900 the work was limited to one plat. The soil, which is classified as clay loam, was plowed February 26th to a depth of seven inches. The plat was harrowed immediately after plowing and again prior to seeding. On March 2nd, the oats were put in with a grain drill at the rate of 3.2 bushels per acre. The soil was in good condition at time of seeding and the grain germinated promptly. The crop made a very fair growth during the season and was harvested June 16th. Texas Red variety was grown and it gave a yield of 72 bushels of grain per acre and 2.19 tons of straw.

RESULTS IN 1901.

In 1901, four plats were seeded to Texas Red oats. These plats are used in continuous work and a three years' rotation is being followed on the series. The crops grown are: first year, corn; second year, oats; and third year, wheat and cowpeas. Two of the plats receive manure from time to time as the yield of various crops indicates the need for same. No manure was applied during the season of 1901. The two remaining plats received no manure, otherwise they received the same treatment as the manured plats. The soil on these plats, which is designated as a clay loam having a heavy impervious sub-soil, is quite uniform in character.

The ground was disked February 28th and plats were all seeded March 1st with grain drill at rate of 2.6 bushels per acre. The soil was in fair condition at time of seeding and the oats made a good growth up to the first of May when they were checked somewhat by dry weather. The oats on the manured plats made a better showing and matured earlier than those on the unmanured plats. On June 20th the oats were har-

vested. The manured plats gave an average yield of 54.5 bushels of grain per acre with 1.24 tons of straw, while in case of unmanured plats the average yield per acre was 28.6 bushels grain and .54 tons of straw. This gives a difference of 25.9 bushels of grain and .7 tons of straw in favor of manured plats.

RESULTS IN 1902.

Four plats were seeded to oats in 1902. Three of these plats were one-eighteenth of an acre in extent and were used in making a comparison of three different varieties, namely, Lincoln, Culberson and Texas Red oats. The fourth plat contained one-half acre and was seeded to Texas Red oats. The soil, which was quite uniform in character, has been described under experiments for the years 1900 and 1901. In the case of the individual plat, the ground was plowed the 21st of January. The plat was seeded to oats with grain drill on March 4th at rate of 3.1 bushels per acre. The soil was disked and harrowed prior to seeding. The thrashing was done June 24th and the crop gave a return of 65.3 bushels per acre with 1.32 tons straw.

The treatment of soil in case of the varieties was somewhat different as compared with the individual plat. Cowpeas were grown on the field during the season of 1901 and the soil was kept clean and in good tilth by frequent cultivations. The cowpeas were harvested August 28th and the soil was given a thorough disking. Two plats, 39 and 40, were seeded to Culberson and Texas Red oats respectively. These made a fair showing in the fall but killed out during the winter. In the spring the portion of the field included in this experiment was disked and seeded at the rate of three bushels per acre from March 6th to 15th. The crop was harvested the 26th of June and the yields per acre were as follows:

	Grain Bu.	Straw Tons.
Texas Red	57.5	1.29
Culberson	46.4	1.03
Lincoln	45.3	1.13

In this test, the Texas Red oats gave a yield of 12.2 bushels more per acre than the Lincoln variety and 11.1 bushels more than the Culberson variety. These results are in accord with results which have been obtained at the station in previous years. The Texas Red variety has proved to be one of the most promising varieties in the list. In comparing the yields of oats from the smaller plats with the yield from the large plat there is still a greater difference in favor of the Texas Red variety.

RESULTS IN 1903.

The work during the season of 1903 may be divided into two distinct experiments. First, oats grown in rotation of five years on manured and unmanured plats; second, time of seeding with different methods of cultivation in the preparation of the seed bed. In the first instance Texas Red oats were grown while in the latter case Texas Red oats were used with a mixed variety, sown in about equal parts.

OATS IN ROTATION.

The plats in this experiment are located on Field D and a five year rotation is carried out as follows: Castor beans, Kafir, cotton, oats, wheat and soy beans. Two plats receive manure whenever crops appear to indicate a need for same. Manure was applied to these plats prior to plowing land for crop of cotton which was grown during season of 1902. The remaining plats have received no manure, otherwise the treatment of the series in regard to cultivation is the same. On March 31st the plats were plowed to a depth of six inches and the cotton stalks which had been previously cut with a stalk cutter were turned under thoroughly. The ground was then double harrowed and the grain was sown at the rate of 2.6 bushels per acre. The soil at the time of seeding was in an ideal condition hence perfect germination was obtained. A very heavy rain occurred on April 9th and the soil was washed to quite an extent. In many cases the young plants were completely submerged in the sediment which was deposited. If light showers had not followed, conditions would have been very unfavorable for growth in a few weeks because the soil was very compact and with no cultivation to check evaporation, the plants would have lacked for moisture. The season as a whole was moist and the oat crop made quite a rank growth. Conditions were exceedingly favorable for the development of rust and the crop, not only on the station farm, but also over a large portion of the territory, was seriously injured by it. Plats that under normal conditions would have given a yield of sixty or more bushels per acre gave a return of ten to fifteen bushels per acre. Loose smut was also quite prevalent on all plats this season. The crop on these plats was harvested on July 6th. This is much later than usual for harvesting owing to the fact that oats were not seeded until quite late. The oats on manured soil gave an average yield of 9.12 bushels per acre, with 1.66 tons of straw, and the unmanured plats gave an average yield of 10.6 bushels per acre with 1.42 tons of straw. In

making a comparison of these results, we find that the manured plats produced the largest average yield of straw but the average yield of grain was lower by 1.48 bushels than the amount produced on the unmanured plats. This fact should be considered, however, that rust developed to a greater extent on the straw of oats grown on manured ground, hence the yield was diminished.

TIME OF SEEDING.

Considerable rainfall occurred during the month of March, 1903, and as the soil was already well saturated with moisture which had fallen during the winter, it was impossible to prepare a seed bed for the oat crop at an early date. Under such circumstances the question always arises, "Will it pay to take time to plow land which has not already been plowed or shall surface cultivation be given and the crop seeded as soon as possible?" Again, would it be preferable to allow the soil to settle and thus cultivate at a time when a larger area could be covered per day at a much lower cost? With these questions in view an experiment was outlined and carried through in order to obtain if possible some information on the line indicated.

Eighteen plats were used in this work and they were divided into three series, each series being carried through in duplicate. First series: Plats 1 and 10 were plowed to a depth of five inches and seeded to oats with drill at rate of 3.0 bushels per acre on March 17th to 20th. The soil was harrowed after plowing. Plats 2 and 11 were double disked, harrowed and drilled at same rate per acre and on same date as above. On plats 3 and 12, the oats were sown broadcast and the ground was double disked and harrowed on same date, March 17th to 20th. The plats were seeded at the same rate per acre as plats 1 and 10. The soil at this time was very wet and it was almost impossible to work machinery. Six plats were used in this series.

Second series: Plats 4 and 13 were plowed to a depth of five inches, harrowed and seeded to oats with drill at rate of 3.0 bushels per acre on March 28th to 31st. Plats 5 and 14 were double disked, harrowed and seeded to oats with drill using same amount of grain per acre, and on same date as plowed plats, March 28th to 31st. Plats 6 and 15 were a repetition of work as followed on plats 5 and 14. The soil was in a much better condition at this time for working as compared with the earlier seeding, but it was still quite moist in places.

Third series: Plats 7 and 16 were plowed to a depth of five inches, harrowed and seeded with drill at rate of 3.0 bushels per acre on April 7 to 9. Plats 8 and 17 were double disked, harrowed, and seeded with drill at same rate per acre and on same date as plowed plats. Plats 9 and 18 were given the same treatment as plats 8 and 17, and were seeded at same time. The soil was in much better condition for seeding at this date than at either of the earlier seedings. Very heavy rains occurred after the first series had been seeded and again on April 9th after all plats had been sown. The soil was not only washed to a considerable extent but it was also packed quite firmly and the young plants were forced to grow under somewhat adverse conditions.

As noted in the former experiment of this year the weather during the growing season was rather moist, but oats on this field did not make as rank a growth as on other fields. The soil would be classed as upland and as no manure has been applied to the field for some time, the soil is rather deficient in humus. In the second place, rust developed to quite an extent on all plats, and more especially on plats that were put in late than on the early seeding plats, and this had a tendency to reduce the yields very materially. This was quite apparent in connection with returns from the late seeding plats. The oats on these plats made a ranker growth than those on early and medium seeding plats. The soil on the early and medium seeding plats was packed quite firmly by the heavy rains which followed seeding, thus placing the oats under somewhat more unfavorable circumstances for growth in regard to the physical condition of the soil than the crop which was seeded at a later date.

AVERAGE YIELD OF OATS FROM PLATS RECEIVING SAME TREATMENT.

Plat No.	Yield Straw	Yield Grain	Tests	Date of Plowing & Seeding	Treatment which plats received.
1 & 10	.51	15.7	26.5	March 17-20	Powed, harrowed, drilled
2 & 11	.46	12.6	25.0	March 17-20	Double disked, har., dr'ld
3 & 12	.55	12.8	25.0	March 17-20	B'dc'st, d'ble d'sk'd, har.
4 & 13	.73	6.0	17.0	March 28-31	Plowed, harrowed, drilled
5 & 14	.67	8.2	20.0	March 28-31	Double disked, har., dr'ld
6 & 15	.62	9.0	18.2	March 28-31	Double disked, har., dr'ld
7 & 16	.65	3.2	16.2	April 7-9	Plowed, harrowed, drilled
8 & 17	.60	4.5	16.5	April 7-9	Double disked, har., dr'ld
9 & 18	.69	2.7	16.0	April 7-9	Double disked, har., dr'ld

In summing up these results we find that the early seeding plats gave the lowest yield of straw per acre, and highest yield of grain. The grain in this case also gave a better test per measured bushel than the medium or late seedings. In the early seeding, the plowed plats gave the largest returns in yield of grain as compared with plats which were worked up with a disk. With the later seedings the reverse is the case and we find that the disked plats give the largest yield of grain but do not give as large a yield of straw as plowed plats. The yield of grain on the plowed plats of the medium and late seedings may have been influenced by the extra amount of rust which developed on these oats. The crop was more luxuriant on plowed plats than on land which received surface cultivation only, hence rust had a better chance to grow and spread on these plants.

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